Before the FEDERAL COMMUNICATIONS COMMISSION Washington, DC

In the Matter of

Inquiry Concerning Deployment of Advanced
Telecommunications Capability to All Americans
in a Reasonable and Timely Fashion GN Docket No. 17-199

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Comments of Professor Sharon Strover:

I submit the paper below, recently presented the TPRC Conference in Arlington, VA (September, 2017), in support of our conclusion that altering the standard for "broadband" for mobile based technologies does not support the goal of effective and usable Internet access for rural populations. Our study, based on rural populations in Kansas and northern Maine, demonstrates that mobile phone-based services are spotty and unreliable in many rural regions. They also are quite simply unaffordable with prices charged for conventional data plans. Our research around a free, library-loaned hotspot program in our two states that afforded local populations free access to the Internet, underscores the importance of dependable, reasonably priced Internet access.

Libraries, the National Digital Platform, and Inclusion

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Abstract: Wireless hotspot lending programs are gaining popularity through library systems in several major cities in the U.S. Portable hotspot devices allow a patron to "take home" the Internet from the library, and are premised on providing free, cellular-based mobile access for Internet-ready devices in the home, usually to people who indicate they lack home-based broadband. In 2015, the New York Public Library collaborated with the Maine State Library and the Kansas State Library to fund rural hotspot lending programs in small rural community libraries.

Extending the reach of Internet-based services in this fashion is a new addition to rural libraries' functions, and this research seeks to understand how these programs impact the users and small communities where they operate. Extremely rural areas typically have less robust Internet services available commercially and lower home broadband adoption levels; research suggests the prices for fixed broadband services are sometimes much higher than the local populations can afford.

Under a grant from the Institute of Museum and Library Services, our research assesses hotspot lending initiatives in 6 rural libraries in Maine and 18 libraries in Kansas. Most of the communities in the sample face several economic challenges. The hotspot programs themselves are fairly small (as are the communities in which they operate), but they provide insights into the role and operations of information seeking in areas bereft of many alternative sources while also providing a way to examine how libraries extend Internet access into underserved areas.

The research investigates 1) how rural libraries implement and operate a hotspot-lending program; 2) their potential economic impacts in the community; 3) and larger community outcomes that might be associated with increased connectivity in rural areas. Our team of researchers investigated these outcomes through site visits to the libraries and their counties and towns, where librarians and local stakeholders - elected officials, school personnel, local telecommunications providers – provided qualitative data regarding Internet access, the hotspot program, and local information needs. Focus groups and interviews with hotspot users were conducted in several sites.

In this paper we share the results of focus groups with patrons who utilized the device and characterize how this particular program may or may not influence broader information seeking and the use of various Internet-delivered services. The policy implications of the resources involved suggest some additional targets for remedying digital divide-related environments.

Our findings from qualitative interviews and focus groups underscore the significance of (1) affordable broadband access solutions, (2) the uneven quality of local access in rural areas, and (3) how libraries operate within a heterogeneous state and federal policy environment to serve their communities.

Introduction

Wireless hotspot lending programs are gaining popularity through library systems in several major cities in the U.S. Portable hotspot devices allow a patron to "take home" the Internet from the library. These programs are premised on providing free, cellular-based mobile access for Internet-ready devices in the home, usually to people who indicate they lack home-based broadband. In 2015, the New York Public Library collaborated with the Maine State Library and the Kansas State Library to fund rural hotspot lending programs in small rural community libraries.

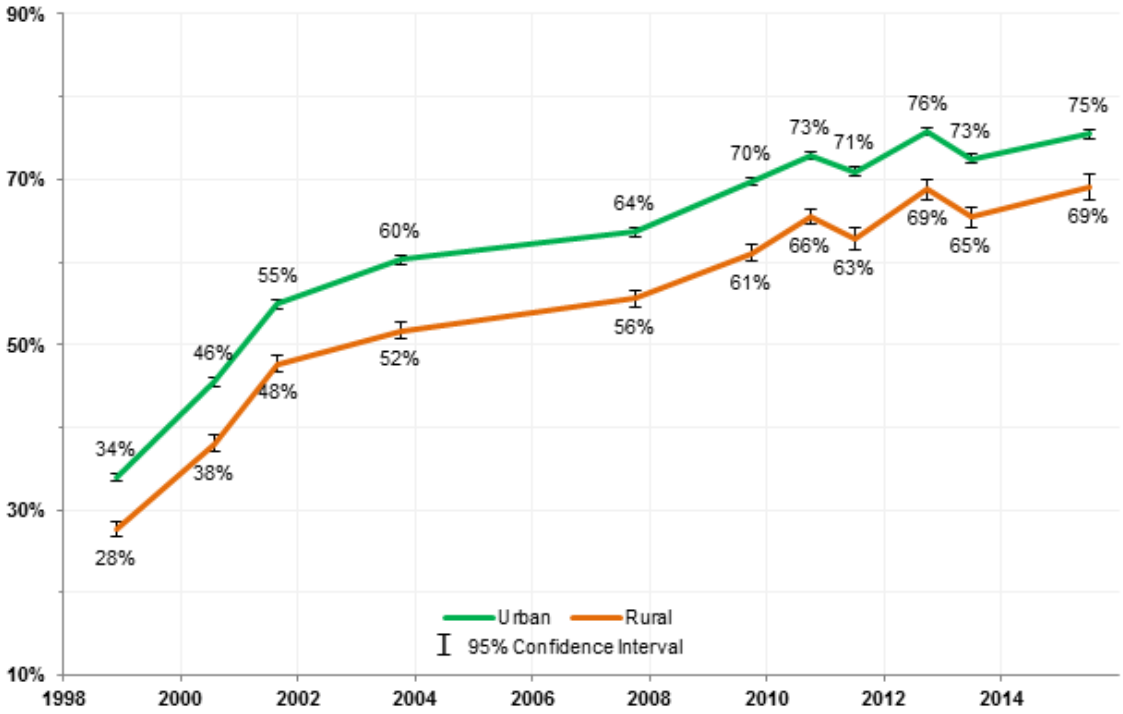
Extending the reach of Internet-based services in this fashion is a new addition to rural libraries' functions, and this research seeks to understand how these programs affect the users and small communities where they operate. As discussed below, extremely rural areas typically have less robust Internet services available commercially and lower home broadband adoption levels; research suggests the prices for fixed broadband services are sometimes much higher than the local populations can afford. Local libraries are typically the only place where people in these communities can access the Internet for free and/or at reasonably fast speeds. As more educational, health, government and commercial services assume user Internet access, libraries stand out as particularly prized sites for these purposes in rural towns.

Background

There are ample statistics demonstrating the deficiencies of Internet service in rural parts of the U.S. Few people dispute that the broad population needs Internet access for a growing array of services and goods, and increasingly to participate in routine governmental, health or education activities such as renewing licenses, enrolling children in school, or filing insurance papers.

According to the Pew Research Center (2017), about 88% of American adults use the Internet (with home broadband use at 73%), but many studies have shown population variation in terms of use patterns, digital capabilities, and perceptions of affordability. For example, Internet availability and use variations by age, race and ethnicity, income, education and location have been demonstrated in various reports from NTIA (2016). One consistent disparity occurs between metro or urban locations and residents versus rural regions and populations: in terms of both Internet infrastructure availability and Internet use, patterns differ (Figure 1).

Figure 1 Internet use by population density, 1988-2015 (NTIA)



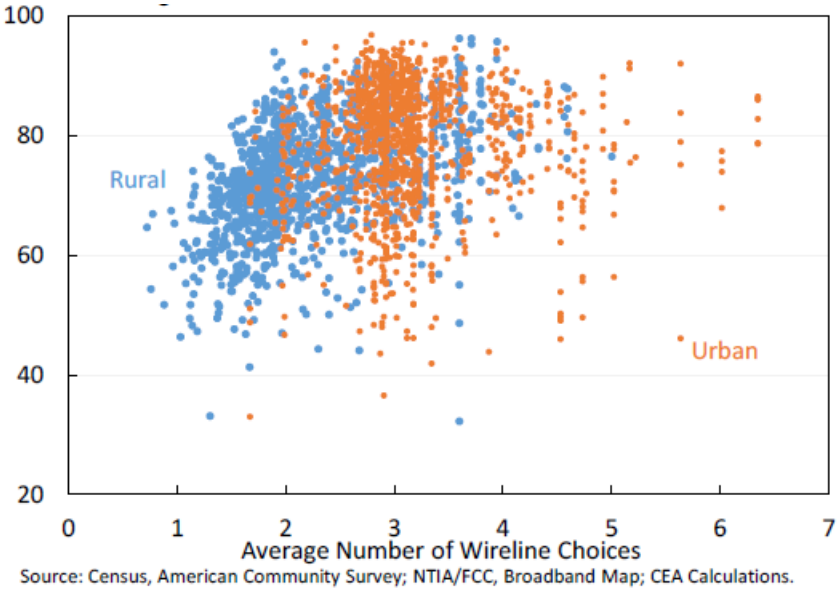
Source: NTIA (2016)

In response to this discrepancy, several policy initiatives and programs aim to boost the capability of local institutions to assist rural populations with Internet needs. For example, President Obama's signature broadband programs funded under the American Reinvestment and Recovery Act or ARRA (2009) created the Broadband Technologies Opportunities Program (BTOP) and the Department of Agriculture's Broadband Initiatives Program (BIP). They invested in providers (the exclusive focus of BIP in rural regions) as well as community organizations and middle-mile networks (BTOP) around the country.

These programs highlight not just the noncompetitive nature of infrastructure in rural regions – most at that time had a single broadband provider (see Figure 2) – but also the potential role of local community institutions in providing broadband access (Council of Economic Advisers, 2016). To a certain extent, the role of local institutions was nothing new: local schools and libraries, community centers and local advocacy groups had long acted to level the playing field in terms of technology access

and use, dating from the earliest availability of computers and moving through Internet access.[1] When it comes to rural regions, however, the list of stakeholder institutions that can provide Internet-related services shrinks: schools, libraries, and perhaps the local town's government offices comprise the likeliest candidates. If a rural region has a local medical facility, that facility may offer wifi to the public and also use Internet connectivity to deliver services. Advocacy organizations and other sites such as job training centers or public workspaces are few.

Figure 2 Internet use by provider choices by location



Source: Census, American Community Survey; NTIA/FCC, Broadband Map; CEA Calculations.

One other salient aspect of rural regions concerns the impact of new technologies, notably smartphones. Eight years ago when ARRA was passed, smartphone penetration was under 35%. Indeed, the term "smartphone" was novel. Pew Research began publishing data on it only as recently as 2011. In the context of digital divides, smartphones – providing access to many of the information and services associated with the Internet – have become a more affordable, more available, and more versatile alternative to home broadband for some populations, particularly minority and rural populations.

[1] The Technology Opportunities Program under NTIA dates from the early 2000's, for example, and supported "new telecommunications and information technologies to provide education, health care, or public information in the public and non-profit sectors" (https://www.ntia.doc.gov/legacy/otiahome/top/).

As of 2017, Pew (2017b) reports that most of the U.S. population has some sort of cellphone (95%), and that 77% own smartphones. While cellphone services in rural areas were slow to develop, most people do now have cellphones even if coverage is inconsistent; the use of smartphones stands at 67% in rural areas compared to 77% in urban areas. Nevertheless, U.S. communication policy has at times considered wireless access to be a possible solution to Internet access in rural regions (see FCC 2010 Broadband Plan); whether provided through smartphones, fixed wireless or some other spectrum-based technology, the cost prospects of wireless seem more positive compared to completely wiring rural regions.

We bring this up primarily because mobile services – specifically smartphone services – may be justified as the primary way that rural populations can access the Internet. (At this writing, there is some debate at the FCC regarding whether mobile access can be interchangeable with fixed access in terms of evaluating Section 706 Inquiries on "advanced telecommunications capabilities". The FCC under Chairman Wheeler declared them complementary services and offered that both are needed (See Ars Technica, 8/9/2017).

The composite picture of rural Internet access then is one in which

(1) fixed broadband infrastructure is less competitive and often less capable of delivering 25/3Mbps broadband service, the current FCC definition of broadband;
(2) the percentage of the rural population regularly using the Internet is lower than in metro areas;
(3) smartphone coverage in rural regions is less competitive and is spotty in coverage, and there is lower use of that technology among rural populations;
(4) there are fewer institutional alternatives in rural regions to assist with broadband access and training.

This brings us to the current research focusing on the potential role of libraries in rural regions' Internet information ecosystem. As one of few predictable points of both digital training and free broadband access in rural communities, libraries may have important roles in mitigating digital disparities. We already have federal and state policies supporting their services in many ways, and consequently examining rural libraries' performance in the challenging service topography of rural America can provide insights into their potential position in an Internet world.

Libraries, rural regions and programs in Maine and Kansas

As library systems nationally have embraced digital services and technologies, rural libraries likewise have sought ways to bring electronic services to their constituencies, including Internet access. Libraries everywhere have supported access to in-library computers for years, which evolved into networks

delivering high-speed services.[2] Many libraries also provide in-library wifi, enabling people to bring their own devices to the library to use its service – especially attractive as a way for patrons to offset data charges. In terms of institutions in rural areas that bridge digital divide-related disparities, libraries figure prominently: they are free, open year-round, frequently offer the peripheral services such as printing that people may need, provide classes and training, and have some modicum of technical support. They are logical institutions to help remediate digital disparities in rural regions. As well, federal policy recognizes their significance as important computer and Internet access sites through the E-rate program.

Our research examines some of the latest ways libraries are providing digital services through the loan of hotspot devices to library patrons. The program we analyze here originated when the New York Public Library System shared funding with the public library systems in Maine and Kansas to support the loan of mobile hotspots to library patrons. The latter two states prioritized rural libraries in setting up two independent programs to extend free Internet access to rural library-users through the hotspots, which operate on cell phone signals to provide a link between a personal device (such as a laptop or tablet or phone) and the Internet.

Our research assesses hotspot lending initiatives in 6 rural libraries in Maine and 18 libraries in Kansas. Many of the communities in the sample face several economic challenges and are emblematic of digital equity targets. The hotspot programs themselves are fairly small (as are the communities in which they operate), but they provide insights into the role and operations of information seeking in areas bereft of many alternative sources while also providing a way to examine how libraries extend Internet access into underserved areas.

Maine allocated its 80 devices among just six libraries but constructed a two-year hotspot plan linked to a statewide educational program called the Maine Learning Technology Initiative (MLTI). The MLTI is premised on insuring that K-12 public school students have access to an electronic device (typically a tablet or laptop, available to 7th or 8th graders) and that teachers have technical support in order to develop curriculum appropriate to digital access. The idea behind Maine's hotspot program is that it would pair with the MLTI program to make sure that families with students who had a MLTI device would be eligible for the hotspots. This partnership remedies the problem that children get electronic homework premised on easy Internet access, but then many lack access at home in order to actually complete the homework. The data plan associated with US Cellular is more limited than that of Verizon's in Kansas: they provide data capped at 2.5G per month, and when the device reached the cap it shut down.

[2] The FCC 16th broadband progress report reports 100 Mbps per 1,000 students and staff as a short-term benchmark for telecommunications capability to elementary and secondary schools and libraries." (FCC, 2016, Section 71, p. 30).

The approach in Kansas was to offer a total of 95 devices and an accompanying data plan from Verizon to 18 participating libraries for one year. The philosophy was that if individual libraries liked the program, they could then find their own funds to continue it beyond the grant's expiration. The number of hotspots allocated to individual libraries was typically low – the highest number in any one library was eight hotspots at the outset – and initially there was a data limit of 6G per month on the service. After complaints and negotiation, the provider, Verizon, altered the plan to unlimited data. Most Kansas libraries chose to loan out the devices for a period of one week, and waiting lists became common (and lengthy in some instances). At this writing, there are still several libraries maintaining their hotspot service, with the numbers of hotspots having increased to as many as 20 (Johnson City) at one site. Table 1 provides details on the libraries.

Table 1 Kansas and Maine libraries' population and rural-urban continuum codes

Kansas	**Library**	**Total Population**	**Rural Urban Code**
Atchison	Atchison Public Library	11201	6
Clearwater	Clearwater Public Library	2481	2
Lyndon	Lyndon Carnegie Library	1054	3
Meriden	Meriden-Ozawkie Public Library	813	3
Carbondale	Carbondale City Library	1437	3
Quinter	Jay Johnson Public Library (Quinter)	918	9
Coffeyville	Coffeyville Public Library	10295	5
Independence	Independence Public Library	9483	5
Effingham	Effingham Public Library	546	6
Wetmore	Wetmore Public Library	368	6
Goodland	Goodland Public Library	4489	7
Sabetha	Mary Cotton Public Library (Sabetha)	2571	6
Great Bend	Great Bend Public Library	15995	7
Haysville	Haysville Public Library	10826	2
Jetmore	Jetmore City Library	867	9
Johnson City	Stanton County Public Library (Johnson)	1495	9
Syracuse	Hamilton County Library (Syracuse)	1812	9
Silver Lake	Silver Lake Public Library (Shawnee)	1439	3
Maine	**Library**	**Total Population**	**Rural Urban Code**
Cherryfield	Cherryfield Public Library	1232	7
Calais	Calais Free Library	3123	7
Steuben	Henry D. Moore Library	1131	7
Lubec	Lubec memorial Library	1359	7
Jonesport	Peabody Memorial Library	1370	7
Eastport	Peavey Memorial Library	1331	7

*RUCC is based on the 2013 county-level statistics, see USDA. (2013, May 10). United States Department of Agriculture, Economic Research Service: Rural-Urban Continuum Codes, 2013. Retrieved from http://www.ers.usda.gov/data-products/rural-urban-continuum-codes.aspx

Research Questions and Method

The broader research project investigates 1) how rural libraries implement and operate a hotspot-lending program; 2) their potential impacts in the community; 3) and broader matters of Internet connectivity and affordability in rural communities, and where rural libraries fit as a local information and service source.

We examine the program through site visits to the libraries and their counties and towns, where librarians, local Internet providers, local stakeholders - elected officials, school personnel, local telecommunications providers – and hotspot users themselves provided information regarding Internet access and the hotspot program, and local connectivity.

In this paper we share the results of qualitative interviews with library staff and stakeholders as well as focus groups with patrons who utilized the hotspot devices. We conducted six focus groups with hotspot users and one with nonusers in Kansas, and conducted 29 interviews in Maine and 69 in Kansas as of May, 2017. While these data do not lend themselves to statistical summaries, they offer strong evidence of the conditions in which libraries operate, the shape of rural broadband, and the role libraries may play in facilitating better services in rural areas.

The core questions addressed in this paper are:

- What are the impacts of the hotspot lending program, especially in terms of quality of life, digital literacy and social capital?
- How do community libraries make institutional contributions to rural broadband challenges?

These two questions lead to broader policy considerations addressed in our final sections. Both the nature of the larger information ecosystem in rural communities and libraries' anchor institution status are discussed in light of digital equity concerns and the current technology and policy landscape.

Findings

Hotspot program impact

Organizational and technical issues affect how the program was able to achieve its outcomes. When the hotspots worked well, both libraries and users found a range of applications for the mobile connectivity they offered.

Organizational and technical issues

Clear results answer the straightforward question of whether hotspots "work": where a good cell phone signal exists, they work and are relatively easy to use. Both states chose providers (Verizon in KS, US Cellular in ME) with decent coverage in their respective regions. However, it was clear that geographical coverage is a very granular experience. Coverage maps that are publicly available from the FCC, for example, represent aggregated data, and we found they typically overstate both the number of providers available for residential and small business uses as well as actual locations they reach.

In both Kansas and Maine, a few locations were limited by signal reach. In Kansas, libraries lacking cellular coverage returned their devices to the State Library for reassignment to another location. In Maine, some libraries found that signal strength and location varied over time when providers' antennas were removed or shifted. In two libraries, initial positive hotspot experiences were tempered when cellular signals disappeared, rendering the devices nonfunctional. In those cases, the organizational response for remedying coverage or shifting the hotspots to other areas did not function well, and hotspots went unused. Compared to Kansas libraries, the Maine libraries also had less signage advertising the hotspots, and it appeared that some librarians were somewhat less enthusiastic about their utility as well, factors that may have influenced hotspot use.

In some Kansas communities local users said they would have preferred to work with some other local entity – their local phone cooperative, for example – in conjunction with the hotspot. This reflected familiarity and trust in local companies even though there were few complaints about either Verizon or US Cellular when those companies could indeed provide a signal.

One testament to the hotspots' utility rests in the fact that many KS locations had waitlists for the hotspots. Indeed, in one focus group, users said they stopped telling people about the hotspots because they did not want to jeopardize their own position in the waitlist (Goodland focus group, July 2017)! When we visited the Coffeyville KS Public Library the current waiting list carried 47 names on it. One site increased its hotspots to 20, up from an initial four. In other evidence of the hotspot's value, one couple that lacked home broadband entirely said they checked out the hotspot so their children could do homework using it, and later panicked when they realized they were not going to be able to get into town to return the device at the designated time; this could incur a library penalty that would mean no access to the hotspot for over a month, a disaster for them.

Maine's program prioritized loaning the devices to families with school age children in order to support the MLTI program. However, two of the six libraries experienced connectivity problems, and the others never saw high demand for the hotspots. People in many of our interviews claimed that home

connectivity was a problem for children, but some school personnel insisted that children had "enough" connectivity to complete homework.

Uses of the hotspots

What did people use them for? There is a long list of uses that one might expect, and several surprises. We found a homeschooling constituency in both states using the hotspots for lessons. In Lubec, ME for example, the librarian reported

> "the one family that uses it constantly is a home school family. [I] told them about the program. The home school family explained that one of their daughter's online course's had video that would eat it up. So the same family would come get a new device every week." [Lubec Memorial library, August 2016]

The Lubec librarian herself also checked one out for her son to do homework while home from College. A small, religious community in Sabetha KS also had a large percentage of homeschool children, and there too the hotspots were popular and necessary to access online curriculum and cooperative educational materials.

Using the hotspots for educational purposes was common in these rural communities, and some of the uses had to do with using the long stretches of time people might spend in transit from one place to another. The long distances between these rural communities place constraints on families and schoolchildren traveling to extracurricular and scholastic activities. In one location, coaches checked out the hotspots so that team members could complete homework during team bus rides. The MLTI program in ME prompted people there to do the same thing: "For many families, the MiFi devices allow them to take advantage of the laptops they received through the one-to-one program. Often, sports teams and classes on field trips would take the devices on the bus so that students could do their schoolwork while traveling" [Jonesport librarian, August 2017].

People reported taking the hotspot on long car trips (perhaps to relatives' houses) so they could do homework and other things. One couple living outside of Johnson City in SW Kansas used hotspot-provided connectivity to complete their GEDs, engaging the classes and homework in the evenings after work. Another woman used the hotspots to complete training for a certification in medical assistance. We heard from parents who used the device in order to access school portals to check in on their children's performance.

The challenges of spending a long time in transit made having hotspots highly desirable for some people. One woman reported that she created a map of all the libraries checking out hotspots in KS.

She belongs to 21 libraries in Kansas due to extensive personal travel throughout the state! [Mary Cotton Sabetha Library interview, 2017] A teacher doing in-service training at various schools used one for her work since she could not get access to other sites' networks on a routine basis. People doing real-time mission work sometimes used the hotspots in their door-to-door work to illustrate resources or provide other online information to people with whom they worked.

A few libraries in Kansas reserved one of their hotspots specifically for community events so that people could processes credit cards or generate lists at events such as a local county or city fair, a meeting of a national conference for pheasant hunters or a high school reunion. The mobile quality facilitated pop-up applications that helped the community.

Additionally, the hotspots facilitated a certain amount of privacy that was impossible in the public setting of a library. For example, one woman was processing adoption papers at home using hotspot connectivity, an endeavor she felt a little self-conscious about undertaking in the library. People using them to connect to continuing education services felt similarly. Another music aficionado used the hotspot to stream music wherever he went; again, long periods of time in the car made the hotspot especially useful. Users reported that they believed it was more secure than library wifi (the devices are password-protected). Alongside privacy, extended periods of time to use the mifi seemed to cultivate more Internet skills and unstructured learning. As one person put it, "sometimes having that ready access, you just experiment a little more." [Coffeyville, March 2017]

Affordability plays a crucial role among hotspot users. Most people in our focus groups had mobile phones and the majority had data plans, but they often had very *limited* data plans because higher levels cost too much. A few people recounted that they had had hotspots at home or cable-based Internet service, but had to give those up when their charges went too high. One patron saves up his Internet tasks for the occasions when he has hotspot access. Several users relied on their turn with the hotspot to do more intensive work on the Internet, saving up their tasks until they had it:

> …we are kind of in a valley, so our options were very limited. So we ended up getting our own hotspot through Verizon. But we only buy 2 GB a month, which isn't very much. So yeah, we hit the limit – I mean, we mainly just do like e-mail or check [weather] if we're going to do any online SnapFish, Shutterfly, and some banking. Otherwise, if we want to research anything, we wait until we have the hotspot. [Mary Cotton interview]

The desirability of the hotspots prompted one KS library to allow people to reserve them for one day at a time for an additional charge. [Coffeyville, March 2017] We heard complaints about the cost of either

cable-based service or cell service with data plans repeatedly throughout our interviews. The hotspots clearly played a role in economizing for these populations.

Rural Broadband and Libraries

Given the often fragile or expensive Internet access in rural areas, libraries are important sites for accessing information and for a range of social services that may or may not involve the Internet. The hotspot program was a draw for some people, and its popularity in Kansas underscores the importance of broadband for the population. Supporting children's use of the Internet for school was a significant component of the hotspot appeal, and for libraries more generally in rural areas.

First, people learned about the hotspot in various ways. All the libraries generally had Facebook pages that noted the program, and the State Libraries in both ME and KS had prepared flyers to post. Maine had a "kick off" event in Cherryfield with a fair amount of PR. However, we heard that word-of-mouth was powerful in these communities for alerting people to the hotspot program. In Goodland, for example, the librarian reported that several people who had not been library users came in for library cards specifically in order to check out hotspots – perhaps as many as half of the hotspot users were not frequent library users.

That said, most of the local officials associated with schools, town government and economic development had no knowledge at all of the hotspot programs. In spite of this there was uniformly strong support for the local library even if some librarians reported that many people have no idea what the libraries do.

"What libraries do" encompasses a broad range of services and classes, going well beyond checking out books. Most have extensive children services that are especially active in the summer. A surprising number provided lunch for children in the library during the summer - some are the official sites of free and reduced lunches in their communities (Osage, Leavenworth, Goodland among others). Another library was a "safe drop off" site ("A Family Place" is the term of art) where estranged parents could transfer children. Many offer a range of classes, and if they are big enough, host meetings of local community organizations. (Even the tiny Quinter library hosted an exercise program in their community room.) The Goodland library is Smart Start certified so that they can provide families with social and health services. In a few cases, libraries became explicitly linked to school programs – when one school district mandated online registration, for example, the local library was the place that became flooded with perplexed parents trying to register students; in another case, the library's 3D printing facilities filled a gap for shop and art classes that lacked that technology. In other words, rural libraries serve fundamental community purposes.

We summarize what libraries "do" simply because there are consistent and often unnoticed qualities that are relatively underappreciated. Two are particularly salient: the simple presence of a free and available place for computers, Internet connections, and wifi; and a site that is safe and useful for school age children.

Library computers, Internet connections and wifi are especially prized by members of the community. Many interviewees remarked on the extensive use of the computers by children both after school and during the summer.[3] All of the libraries keep their wifi "on" for 24 hours so that people can use it outside of library hours. One site even built a patio to facilitate users' comfort. One local stakeholder remarked:

> "[I] knew of the wifi at the library. It is not uncommon to see people in the parking lot using the internet. I did not know of the MiFi program…[I] thinks it's good because we are trying to promote ourselves as a tourist destination. And there are a lot of places here without internet and that would give you a way to stay connected." [town administrator, Lubec, August 2016]

Nearly every librarian reported the strong use of their wifi after hours. Their availability to seasonal workers who might lack a way to connect was noted, with reference to blueberry pickers in Maine, some agricultural workers in Kansas, and train workers (for the "turnaround," when oil tankers are cleaned).

The hotspot can directly address "homework gap" issues in these rural locations, and they are logical extensions of the libraries' internal computer and Internet support for children. One interviewee in Maine noted:

> "The kids get devices but don't have internet at home. [They] Have to get it at school or at the library…There used to be broadband here [in town]. But it's slow. Very very slow. [Jonesport, August 2016]

In a similar vein, a librarian reported:

> "In Maine, students are given laptops. But as a town with around 60% of residents who are from low or moderate income families, there are still a few students who don't have or have slow

[3] There were multiple instances in which librarians told us directly that families trusted their kids to come to the library and play games on the computers with each other because it kept them out of trouble. One regional service center staffperson told us that part of their goal is for kids to indirectly learn things while at the library- not "learning by osmosis" (they said) but rather other lessons like sharing, being polite, cleaning up after themselves, etc.

> Internet access at home - thus this program provided by the library would bring a giant inclusion for those kids…."

Augmenting the MLTI program was an explicit goal of the Maine program, and in Kansas, supporting various school-based laptop or "one-to-one" programs through library-provided hotspots or connections was greatly valued, particularly by people who understood the extent to which the library worked with children. One utility company interviewee who took his granddaughter to the local library stated that it was always full of children when he visited, which he took as a sign of its: "It is always full!" (Goodland, July 2017).

Finally, these observations around (1) the connectivity resources the library provides to community members and (2) the hotspot program's utility for homework gap issues coalesce into broader management considerations that can shape libraries' contribution to local broadband. Both the Maine and Kansas library operations have network mechanisms that support rural libraries' abilities to deliver broadband.

Maine's statewide telecommunications network, the Maine School and Library Network (MSLN), comprises a crucial input to enabling scaled resource availability in rural regions. Growing from a rate case with phone company NYNEX in 1995, when Maine's PUC ordered the company to return $20 million to ratepayers, the State Library successfully argued that the settlement funds should be devoted to establishing a statewide network that would equip schools and libraries with computers and Internet connectivity (Welch, 2013). It is estimated that this network now saves schools and libraries in Maine roughly 50% of what they might have to pay without it. The network consolidates e-rate paperwork and applications, and offers stronger connections to schools and libraries than might otherwise be affordable – each site has 100 Mbps connections, meeting the FCC goal for institutional connections. Both the network and the state program for student learning devices (MLTI) enabled scale economies for network reliability and quality and for bulk purchases of computer/tablet equipment and related software and support. The recent "Three Ring Binder" middle mile project completed in 2012 using ARRA funding available through BTOP and supported by the Maine State Library as well as private partners, augments the network by providing gigabit throughout to institutions within one mile of its infrastructure.[4]

Kansas has two features that enhance the scale needed to deliver services cost-effectively in rural regions. One will be discussed in the next section – the Kansas Fiber Network. The other, the Regional Library Systems, is directly pertinent to how libraries negotiate rural broadband. To support local libraries, the state is divided into seven regions, each tasked with supporting libraries in its area. Since rural libraries generally do not have the budgets to support their own tech support staff, the scale economies of the system facilitate network and wifi support to small rural libraries. The system enables

[4] This 1100 mile fiber network spans the state's urban and rural regions (Kettredge, 2013).

sharing books, ebook order, technical support, and other resources that would be difficult for a single library to afford.

Maine's Schools and Libraries Network and Kansas' regional systems enable rural libraries to operate more efficiently, bring costs down and extend services. For the hotspot program specifically, both library systems were able to negotiate with single providers in order to get "bulk rates" on devices and data for their libraries, continuing their traditions of leveraging network economies.

Rural Information Ecosystems, Libraries and Policy Considerations

Our interest in the broader rural information ecosystem straddles the desires and needs of local residents with the institutional context that is organized – or not – to meet those needs. There is a reciprocal relationship between what people want and can afford, and the companies or organizations that can satisfy them. Local cooperative businesses (phone companies) that have long held to the principle of serving local communities, figure in this mix, as do local libraries. Broadband services themselves are capital-intensive and subject to various regulatory regimes at both the state and federal levels, regimes often invisible to end users. The Maine and Kansas ecosystems have some similarities, and both highlight some possibilities for libraries' current and future contributions.

The broader information environment for residents in rural regions includes conventional communications systems such as local newspapers (printing weekly or just a few times a week, if a local paper exists at all), local radio, broadcast television, and word-of-mouth systems aided by a local coffeeshop or diner. It seems clear from our interviews and focus groups that online resources are important. For example, Facebook was mentioned frequently, and is used especially by younger people. It came up frequently as an important mechanism for keeping up with friends and family and news in general. The fugitive connectivity these rural towns and populations experienced set the stage for hotspots' contributions to the simple absence of connections, to homework gap situations, and to high-priced fixed or mobile services.

The infrastructure for Internet connectivity for both households and businesses in rural regions may include a town-based cable company, often older and delivering modest Internet service in terms of speeds, and perhaps a local telephone company offering DSL. The latter could include a national company such as AT&T, but our sites were often in the territory of smaller, either independent or cooperative companies such as Pioneer Telephone Cooperative or S&T Telephone Coop in Kansas, or FairPoint in ME, a medium-sized company headquartered in North Carolina. Wireless cell services were generally available, but coverage and quality varied tremendously across service territories. Larger businesses may be able to negotiate with a provider at the enterprise level but the towns and households in our communities had limited bargaining power.

Within the rural information environment we observed, certain institutions are important arbiters of public sentiment and repositories of public engagement. Schools and libraries are fundamental resources for people and have an outsize importance in rural towns. The local school is often a source of pride and a marker of the community's sustainability. Beyond those two institutions, the rural communities we visited had predictable stakeholders who wield influence in how the community operates and the resources it can offer: local technical schools or nearby colleges; a local medical facility; the city/town government (often the largest local employer), which may include a municipally-owned utility company; larger employers in the region; and for larger towns, fraternal associations such as Lions Clubs or Masons or Girls and Boys Clubs. Some of these organizations directly provided local wifi – we saw certain city offices and even medical waiting rooms offer this. In other cases, they could be critical voices for insisting that better broadband be sought, or that what existed was sufficient.

Against this institutional and infrastructure topography, how do residents and stakeholders evaluate their broadband connectivity? What are their needs? Where do libraries and their networked services fit? Affordability and the competitive mix of local Internet options emerge as core considerations.

Overwhelmingly, our focus group members complained about the affordability of mobile cell services, and the poor quality of their local fixed line providers. There were some exceptions to this. For example, in one site there were three providers – one cable company and two local phone companies (one an ILEC and one a CLEC) competing for business within the town (as distinct from the larger region). In that location, we heard few complaints about service or prices, and indeed interviewees mentioned changing providers, or their loyalty to one provider over another. That is to say there was an *awareness* of competition and choice. In many other settings, however, people wanted better service but providers cautioned that towns did not "need" better service or that it was simply uneconomic.

In one illustrative case, a local town's provider (Eagle) recounted the case of another, smaller town nearby in which people complained about their poor service (There, that same company had bought the cable system and an old, fixed wireless system.) The company did not agree that the town really needed faster connections, but finally offered the town a deal: if 250 people would join the existing subscriber base for their cable service, agree to a specific flat investment, and sign an agreement committing their money to the company's service, they would build a new system. The community found the subscribers and people made the investment. This company is now building a system that will deliver 50 Mbps down, 10 up in reasonably priced packages. The company representative stated it would take three years, but "We'll have happy customers…we are employee-owned. Life goes on!" (Eagle Communications, July 2017).

That same company provided free service to libraries in its territory. However, its representatives stated that backhaul was expensive, something we have heard elsewhere from smaller Kansas

telecommunications providers as well. However, 29 local carriers joined together in 2009 to form the Kansas Fiber Network (KsFiberNet). It provides middle mile services to government agencies, medical facilities, educational institutions and other companies in order to reduce the cost of backhaul and to improve bandwidth quality. This network, like the Three Ring Binder in Maine, deployed 2600 miles of fiber across the state to serve smaller companies. (Eagle is one of their clients.) With both of these middle mile arrangements, the costs of expensive backhaul were contained.

Schools and libraries in both Kansas and Maine benefit either directly or indirectly from middle mile networks such as KsFiberNet or the Three Ring Binder, even if a program such as the library hotspot effort is distinct (using the services of Verizon's wireless network in the state). On top of these facilities, a state network such as MSLN considerably reduced last mile telecommunications costs and in all probability provided better connectivity than would have been the case without it. It offered the extra benefit of a centralized mechanism for processing e-rate. By combining the networking needs of at least two major institutions in rural communities – schools and libraries – and sharing with comparable institutions in larger cities, the network is a scale response to a challenging situation.

This environment for fixed broadband service leaves open the role of the companies providing mobile hotspot service - Verizon and US Cellular in this case. While local companies and networks tailor their services to unique communities' needs, are known quantities, may offer training and classes locally, have employees that live next door, and generally are preferred by local residents, national service providers offer the scale to cover entire states with their service. In the case of Verizon in Kansas, libraries were complimentary about its customer service. In response to early complaints about limited and throttled service, Verizon altered its plan to unlimited data without increasing any fees. It solved problems quickly and was easy to work with. The same was not true in Maine, where U.S. Cellular was generally unreachable and nonresponsive. Moreover, its practice of shutting down the hotspot when the low data limit was reached was confusing to people, and the company provided no alterations or work-arounds.

Another important element in the rural information ecosystem concerns economic development. Amid the economic transitions to information industries and Internet-dependent businesses, the question of whether or not rural towns need state-of-the-art broadband in order to be competitive comes up often. Washington County in northern Maine has received several grants to try to strengthen connectivity provided to businesses through a state program called ConnectME, but plans have unfolded on a piecemeal basis. In one Maine library, people lacking Internet simply used the library as a business place:

> **"**In Calais it is not just poor families who don't have internet, some homes just can't get internet… People come in with their laptops and sit on the internet, some work. People are constantly sending faxes. A lot of vacation people taking advantage of the internet. A woman right now had herself an office set up" (Calais interview, August 2016).

A Maine economic development official in Lubec noted that many people like to move to Maine late in their careers, but they would still like to work.

> "If they had adequate internet service, then they would stay and work from home. People are pushing Lubec as a work-from-home town….One guy is retired NASA but still works and tells [us] he's a proponent of upgrading the infrastructure here and what it can do for jobs" (Lubec interview, August 2016).

Several entrepreneurial, home-based businesses were noted in our Kansas interviews: for example, Effingham had several "crafting" entrepreneurs, and people in Sabetha used the hotspots for perusing cattle catalogs for their agricultural businesses. In one telling anecdote, an individual paid $1400 for Cox to put wired Internet in a guest house in Sabetha, which they rent out:

> "See, we usually ping off our neighbors. And then they got new Internet, so I've had them come over because there's a house between us. And we used to never have a problem. We could get on and look up like where there's a movie, where we want to go, Craigslist, whatever. And it's just so slow. And so even now if I take my Kindle, my smartphone, or the laptop and I'll like stand out in front of the other guy's house – and I told him, "Are you guys going to be getting Internet?" Because I did pay $1,400 for Cox to come, because we had a family who stayed there last year for spring break, for March. And when it was all said and done, time their utilities and stuff, I should've paid *them* like $600 to stay there, [by the] time [Cox] moved everything. You know? And then it's like I told Cox. "It's not worth this to keep Internet on down there all the time when we only go every couple months."

Connectivity – even via cell phone - is a valued information age commodity. A Kansas state entrepreneurial support network leader commented that "lack of high speed internet is more of a problem than the size of the town" [in terms of population] and that "The survivability of these small towns really depends on four things: where the school is, is there a grocery store, do young people live there, and is there high speed internet and cell phone service."

Maine businesses would probably agree. A few that we spoke with commented not only on the need for a trained workforce but also on how their fishing-related businesses required Internet connectivity for distribution and inventory. Beyond one-off entrepreneurial efforts, many established businesses in rural areas also clearly required connectivity, but rarely would they fall into the category of heavy users. Marketing and light back office work comprised most retail needs; local Walmarts had their own connectivity; larger institutions such as schools or hospitals negotiated for their needs.

Conclusion: Libraries, rural divides and policy

Where do programs such as hotspot "fit" in terms of policy? Are they sustainable solutions to rural divides? The hotspot programs are illustrations of how extremely local efforts can make a difference in the lives of a rural population. Against the environment of other last mile connectivity constraints of cost, availability, and poor performance, it seems clear that users found viable improvements to their personal Internet environment through the hotspots.

However, the small hotspot programs also highlight the role of scale in solutions that indirectly contributed to their performance. The state networks that created excellent library-based connectivity and wifi, the middle mile facilities that delivered lower costs to providers working with libraries (and other public institutions and private entities), and central leadership that sought highly tailored responses to the problem – all were important organizational and policy responses to rural divides.

These efforts entail a mix of state and federal policies. For example, Maine state policies were needed to authorize the Maine Schools and Libraries Network, which is funded through small fees on phone-related services.[5] The State operates ConnectME grants to assist with localized infrastructure building projects, assisting both households and businesses. Federal E-rate funds help with the MSLN. BTOP funds were instrumental in initiating the Three Ring Binder middle mile project in Maine.

The libraries function as unique, public institutions that can bring these resources together. If the hotspot programs underscore libraries' potential role in extending broadband access to rural residents that sorely lack access, they also highlight the absence of affordable market solutions. Nevertheless, the rural broadband ecosystem also underscores civic-minded institutions – not just schools and libraries but also locally owned provider companies – that are willing to be more creative and attentive to what may be possible in highly specific contexts. Sometimes these creative solutions "fly under the radar" of Washington-style policy endeavors. This in turn suggests that more flexibility and openness to locally or regionally-crafted solutions should be developed in our national policy environment.

[5] LD 256, *An Act To Ensure Continued Availability of High-speed Broadband Internet at Maine's Schools and Libraries*, funding the MSLN, was vetoed by Maine Governor LePage on June 20, 2017. The legislature overrode his veto.

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